

REMARKS

Applicants thank the Examiner for the thorough consideration given the present application, Claims 7, 9 and 10 are currently being prosecuted. The Examiner is respectfully requested to reconsider his rejections in view of the Amendments and Remarks as set forth hereinbelow.

REJECTION UNDER 35 U.S.C. § 103(a)

Claims 7, 9 and 10 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Hirabayashi in view of Kurahashi et al., which is respectfully traversed.

Amended independent claim 7 includes a combination of features and has been amended to clarify that a pulse minute current at least 30% of an inverted maximum current, whose current direction is opposite to that of the current passing through the electromagnetic coil immediately before flowing the offset current, flows for a minute time period before the period where the current value is zero, when a polarity of the applied current of the electromagnetic coil is inverted. Independent claim 9 includes similar features in a varying scope, but is directed to firstly flowing an offset current.

These features are supported at least by Figure 10 and paragraphs [0059] and [0060] of the publication of the present application. Note that the offset current in amended claim 9, which is no greater than 30% of the inverted maximum current, flows during the periods where the current value is zero as shown in Figure 10. In addition, the minute pulse current in amended claim 7 flows before the period where the offset current flows is shown in Figure 10 (see the dotted-lines).

On the contrary, in the electromagnetic pump of Hirabayashi, a plunger is reciprocally moved in the axial direction inside a cylinder by supplying an electric current to aircore

electromagnetic coils, which are fitted around the cylinder so that a fluid can be conveyed from a pump chamber. In Hirabayashi, an electromagnetic force is generated by supplying an AC current to a plurality of the coils, and the force is applied to a movable magnet member so as to reciprocally move the movable magnet member in the pump chamber. Therefore, a return mechanism (e.g., a spring) can be omitted so that a mechanical structure of the electromagnetic pump can be simplified (see column 1, line 33-36 and column 2, lines 43-47).

In the pump of Kurahashi, an upper cylinder 19 and a lower cylinder 20 are fixed to a sleeve 18 provided in a main body section 15 of a compressor 10. Further, a piston 21 having a flange 29 at a mid part is inserted in the upper cylinder 19 and the lower cylinder 20 and reciprocally moved therein, and the upper cylinder 19 and the lower cylinder 20 are communicated by a path 22 formed in the piston 21. Springs 36 and 37 are also provided between the flange 29 and the cylinders 19 and 20 and supported therebetween, and the springs 36 and 37 can be vibrated in the axial direction. Further, a tubular stay 30 is provided to the flange 29. Movable coils 31 and 32 are also provided outside of the tubular stay 30, and they face circular permanent magnets 34 and 35, which are provided on an inner wall of the sleeve 18. By supplying electricity to the movable coils 31 and 32, the movable coils 31 and 32 are attracted to and repelled from the circular permanent magnets 34 and 35 so that the piston 21 can be reciprocally moved against elastic forces of the springs 36 and 37.

Thus, it is respectfully submitted the two references teach away from being combined. In particular, Kurahashi includes a return mechanism (e.g., a spring) as an essential element and Hirabayashi specifically teaches against using a return mechanism. Further, in Kurahashi, when the piston 21 is vibrated, a time period where no voltage is applied is set so as to reduce a

mismatch of mechanical and electrical vibration. However, Kurahashi does not teach or suggest the restraint of rapid pressure fluctuation of the fluid in the pump.

In addition, the Office Action indicates Figure 10 of Kurahashi shows that a time period where an input current is zero is set when the moving direction of the piston is switched, and a minute pulse voltage is input as an input voltage. However, the minute pulse voltage is not purposely input. That is, the minute pulse is “counter electromotive” generated by an induced voltage, which is induced when supplying the electric current to the coils is switched. In more detail, in Figure 10 of Kurahashi, a waveform of the input voltage includes minute pulses which are generated by changing a polarity, but no inverted minute pulse current is purposely supplied to an input current waveform as in the present application.

That is, in the present application, when the current direction is switched at the stroke end of the plunger, the minute pulse current having the prescribed inverted value is supplied, and then the period where the current value is zero is purposely set (see Figure 9 of the present application). In addition, the minute pulse current having the prescribed inverted value and the offset current are purposely generated as shown in Figure 10 of the present application.

Accordingly, it is respectfully submitted independent claims 7 and 9 and each of the claims depending therefrom are allowable.

CONCLUSION

In view of the above remarks, it is believed that the claims clearly distinguish over the patents relied upon by the Examiner, either alone or in combination.

Since the remaining patents cited by the Examiner have not been utilized to reject the claims, but to merely show the state of the art, no comment need be made with respect thereto.

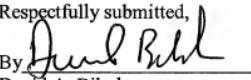
If the Examiner believes for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone David A. Bilodeau at (703) 205-8072 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.147; particularly, extension of time fees.

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Respectfully submitted,

By,



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